In re Patent Application of:
AMMAR
Serial No. **09/863,030**
Filing Date: **May 22, 2001**
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REMARKS

Claims 1-26 remain in this application. Claims 1, 10, 16, 18, 19 and 26 have been amended. No claims have been cancelled.

Applicant requests reconsideration of the Final Rejection mailed April 4, 2003 in light of the above Amendment, the submitted Declaration Under 37 CFR Section 1.132, and the remarks set forth below, which are filed by Express Mail as noted in a phone conference with Examiner Mondt on Monday, June 30, 2003.

Applicant thanks the Examiner for the detailed study of the present application and prior art.

Applicant has amended the claims to place this case in condition for allowance and also submitted a Declaration of the inventor, Dan F. Ammar, under 37 CFR Section 1.132, which stresses the novel and unobvious features of the present claimed invention. The Declaration also includes Exhibits 1-4, which show reduced to practice examples of the thick film millimeter wave transceiver module and showing in Exhibit 1 the multilayer thick film substrate board formed from a plurality of planar sheets of low temperature co-fired ceramic material relative to the size of a quarter. Exhibit 3 is another example of the multilayer ceramic substrate board of Exhibit 1.

Exhibit 2 is an example of the board with attached components, including MMIC chips and different SMA connectors relative to the base of the housing as shown in Exhibit 4, showing the SMT digital section, a millimeter wave section, and showing the various embedded resistors, MMIC chips, RF

filter, embedded capacitors and the base plate, formed as part of the housing.

The present claimed invention is a vast improvement in the development of millimeter wave radio frequency modules, which previously used a high number of MMIC chips, substrates and peripherals stored in each radio frequency module. The present invention makes use of low temperature co-fired ceramic material, such as low temperature transfer tape (Claim 10), also known as green tape, which typically had been used only below 10 GHz or with a MMIC chip package, such as disclosed in the cited and relied upon U.S. Patent No. 5,451,818 to Chan et al. (hereinafter "Chan"), which discloses a hermetic enclosure and enables RF input and output (I/O) and DC bias signals to be communicated through the package walls formed by the ceramic enclosure.

Mr. Ammar's Declaration sets forth clearly that he and others at his company, Xytrans, Inc., were familiar with this type of MMIC package in Chan, showing a base and ceramic substrate 14, including printed, fired etchable conductive layers. In Chan, a dielectric tape 20 was fused at the top surface 14b of the substrate, while RF transmission lines 18 were etched into the opposite surface and used to communicate from the MMIC chip and outside this package. The substrate 14 formed a cavity in which two (or possibly more) MMIC chips 30a, 30b were packaged and covered by a lid and a seal ring. This formed a simple package with a cavity.

The present claimed invention is much different and can be used for a millimeter wave transceiver design with a plurality of MMIC chips used for receiver, transmitter and local oscillator circuits. The board and transceiver are

small in size, as shown in the exhibits, such as 3x3 inches. As now set forth more clearly in the claims, the present invention includes a number of low temperature co-fired ceramic sheets, i.e., green tape layers, stacked (pressed together) on top of each other, for example, as many as 12 or more as noted in the specification. The separate sheets are "burned" and form a planar substrate board having a planar bottom surface and planar top surface on which MMIC chips are preferably surface mounted. A DC signals layer is formed from a separate sheet, a ground layer is formed from a separate sheet, and a device layer is formed from a separate sheet and includes capacitors and resistors and often filters embedded therein that connect to the MMIC chips and to other layers using interconnects within the board. This is advantageous over the prior art such that capacitors and other passives do not have to be placed separate from the MMIC. The present invention has no cavity as in Chan.

Any low frequency signal connections, DC connectors, ground connections and passive devices are embedded in the different sheets forming the different layers of the substrate board. It is possible to attach the MMIC chips by a solder preform layer or silver epoxy and in some of the claims, such as Claim 1, this point is emphasized because the solder preform layer is not positively recited. Another ceramic layer could be positioned at the top surface of the substrate board and include cut-outs configured for receiving MMIC chips in a transceiver layout, i.e., in a receiver, transmitter and local oscillator section. This transceiver design using this multilayer board eliminates many prior art interconnects to any peripherals, such as peripheral capacitors, by using

embedded capacitors and resistors (and filters) and accomplishes interconnection between embedded components and the different sheets and layers using the embedded interconnections within the substrate board. Thus, the number of wire or ribbon bonds are reduced because of the different sheets forming the different layers.

A channelization plate can be received over the planar top surface and provide RF isolation for receiver, transmitter and local oscillator sections. Unique inputs and outputs using coaxial connections, such as SMA connectors, can be attached directly to the substrate and radio frequency waveguide transitions printed directly on a substrate.

It is clear that Chan teaches away from the present claimed invention. Chan teaches, at most, a base, which could be ceramic, and a ceramic sheet on top that does not form a planar top surface, but instead, forms a cut-out, as clearly shown in Chan FIG. 1, to form a cavity in which the MMIC chips are received. The inside periphery of the cavity includes RF signal lines that extend outward.

Chan nowhere suggests the multilayer thick film substrate board used in millimeter wave transceiver modules, which are formed from planar sheets of low temperature transfer tape stacked together to form a single, planar substrate board having a planar bottom surface and planar top surface on which a plurality of MMIC chips are mounted. Nor does Chan suggest the different layers with functions operable to transmit and receive millimeter wavelength signals, including a DC signals layer formed from a separate sheet, a ground layer formed from a separate sheet, and a device layer formed from a separate sheet having capacitors and resistors

embedded therein, and stacked together to form the planar substrate board that is used together with the base plate, channelization plate, MMIC chips and other components to form the transceiver module.

As to the other cited prior art, these references are less pertinent. Wong concerns flip chip technology as compared to a straight chip and wire technology and Shiau uses a thin film technology as a filter. None of these references suggest the claimed invention as now set forth. Moe discloses a base plate with a certain thickness for MMIC hybrid device, but nowhere suggests the present claimed invention. Baudet is directed to soldering a semiconductor device on a support for attaching MMICs, but nowhere suggests the present claimed invention. Osika uses trenches to provide isolation and the trenches extend into the actual silicon, but do not teach a channelization plate to fit over the substrate board as in the present claimed invention.

Applicant contends that the present case is in condition for allowance and respectfully requests that the Examiner issue a Notice of Allowance and Issue Fee Due. If the Examiner has any questions or suggestions for placing this case in condition for allowance, the undersigned attorney would appreciate a telephone call.

Respectfully submitted,

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